Radiological Emergency Management

PREFACE

In a radiological emergency, effects caused by radiation may be a significant concern. Throughout this course, the term radiation refers to ionizing or nuclear radiation. Radiological emergency management is a term that describes efforts to prevent, prepare for, respond to and recover from an event that could result in significant radiation-related effects. Efforts to prevent radiological emergencies include actions to stop such events from happening and actions that decrease the harmful effects of such an occurrence. Efforts to prepare for a radiological emergency include learning the warning signs and knowing what to do during an emergency. Responding to a radiological emergency means taking appropriate actions to protect yourself and others from harm. Recovering from a radiological emergency includes actions performed after an emergency to return to normal.

Ionizing radiation cannot normally be seen by the human eye, nor can it be smelled, heard, or otherwise detected by our normal senses. Radiation can only be detected by radiation detection instruments. This characteristic makes radiological emergencies different from other types of emergencies such as floods, hurricanes or explosions. To prepare effectively for radiological emergencies, it is necessary to understand what radiation is, what types of events can cause a radiological emergency, and what harmful effects could result from such an event. This course is designed to familiarize you with:

- Types of radiological emergencies.
- Potential effects of radiological emergencies on the public.
- Fundamental concepts related to how you can best ensure the safety of yourself and others during a radiological emergency.

Too few people understand that, except in a nuclear detonation, exposure to large amounts of radiation is less likely to cause large scale damage, death, and injury than many of the conventional hazards we have faced for years. For example, more than 40,000 people die on our nation's highways each year. More than 6,000 deaths result annually from fires. An even greater number of injuries and deaths are caused by other accidents such as falling down stairs.

Unlike incidents involving radiation exposure, these accidents are familiar and understandable. Most people do not know what can happen if sources of nuclear radiation are released into the environment. Although hazards may exist when radioactive materials are involved in an accident, these risks may be

exaggerated due to the lack of understanding by the general public. Education is the key to understanding the potential risks and dangers involved in all types of radiological emergencies.

This independent study course is intended to provide members of the general public with an overview of several types of radiological emergencies: radiological transportation accidents, nuclear power plant accidents, nuclear terrorism threat, and other radiological hazards. This overview introduces the nature, degree of hazard, and general emergency response strategies associated with each type of emergency. Specific emergency response guidance, such as how to operate radiation detection equipment or how to respond to a radiation incident, is presented in other courses.

INTRODUCTION

How to Complete the Course

For optimal results, study this course carefully at your own pace. Learning from these materials is different than learning from a traditional textbook. The course is self-instructional and contains all of the information you need to increase your knowledge of radiological hazards.

Do not rush through the course in one sitting. Take a break at the end of each unit and give yourself time to think about the material.

Tests and Review

The course contains a pretest, five units, a final examination and a glossary. You should take the pretest to test your knowledge before you begin studying. You can score the pretest yourself, using the pretest answer key (located after the pretest questions), to determine units requiring additional emphasis.

Within each unit are fill-in-the-blank and true/false practice exercises. The answers to these exercises are located at the end of the text. At the end of each unit, you will find review questions which will test your mastery of the material. You will score the review tests using the answer key provided at the end of each unit.

The final examination, located after the fifth unit, will test the knowledge you have gained from the course. An answer sheet is supplied with the course materials. Drop it in the mail and you will receive your test results in a few weeks. Upon successful completion of the examination a certificate will be mailed to you.

The glossary, located before the final exam, contains definitions of terms related to radiological hazards. The glossary may be consulted while you are reading the units or may be read separately.

How to Take the Pretest

This pretest is designed to indicate how much you know about radiation hazards and radiological emergency management before you take the course. Read each question carefully and select the one answer you think is best. Circle the letter corresponding to the answer you have chosen. Complete all the questions. Do not look ahead at the course materials. Your pretest score will be a useful measure only if you answer all the questions before reading any of the course materials.

When you have completed the pretest, check your answers against the pretest answer key provided at the end of the pretest. This answer key will also help guide you through the text. Each test item covers information discussed in a specific unit of the text which is identified next to each answer.

The pretest should take you approximately 15 minutes. Find a quiet spot where you will not be interrupted. When you have checked all of your answers, begin reading Unit 1.

PRETEST

1. The program designed to protect the population in the event of disasters and emergencies and to minimize the effects of these on the nation is:

    a. National security

    b. Emergency management

    c. Military defense

    d. Nuclear defense

2. The three main types of nuclear radiation are:

    a. Microwave, x-ray, gamma

    b. Alpha, gamma, neutron

    c. Beta, gamma, neutron

    d. Alpha, beta, gamma

3. The amount of radiation absorbed into the body is:

    a. Charge

    b. Exposure rate

    c. Dose

    d. Contamination

4. A unit used to express radiation exposure is the:

    a. Roentgen

    b. Dose

    c. Ray

    d. Curie

5. The rate at which an individual is exposed to radiation is:

    a. Watts per hour

    b. Roentgens

    c. Exposure rate

    d. Dose

6. The most common physical symptoms of early radiation sickness are:

    a. Nausea, changes in blood cell formation, vomiting

    b. Diarrhea, nausea, vomiting, headache, fatigue

    c. Vomiting, changes in blood cell formation, burns

    d. High fever, changes in blood cell formation, nausea

7. One of the delayed effects of high-level radiation exposure is:

    a. Increased risk of cancer

    b. Nausea

    c. High fever

    d. Restlessness

8. Most radioactive material shipments in the United States are made for:

    a. Nuclear power plants

    b. Nuclear weapon production

    c. Medical facilities

    d. Construction sites

9. Type B radioactive material packaging is designed and tested to withstand:

    a. Normal handling conditions

    b. Normal and rough handling conditions

    c. Normal and rough handling, and accident conditions

    d. Abnormal accident conditions

10. Sources of information about radioactive material shipments which are posted on the exterior of vehicles are:

    a. Shipping papers

    b. Placards

    c. Markings

    d. Labels

11. The transport index on radioactive material labels indicates the radiation level _____ feet from the surface of the package.

    a. 1

    b. 2

    c. 3

    d. 4

12. The maximum radiation exposure rate on contact with a package of radioactive material in or on a transport vehicle is:

    a. 10 mrem/hr or .100 mSv/hr)

    b. 50 mrem/hr or .500 mSv/hr)

    c. 100 mrem/hr or 1.0 mSv/hr)

    d. 1000 mrem/hr or 110 mSv/hr)

13. Commercial nuclear reactors generate heat by a process called:

    a. Fission

    b. Fusion

    c. Combustion

    d. Ignition

14. Which of the following is inserted into the reactor core to reduce reactor power or to shut down the reactor?

    a. Primary coolant

    b. Secondary coolant

    c. Control rods

    d. Cladding

15. A cooling tower is used to cool which of the following?

    a. Primary coolant system

    b. Reactor core

    c. Water from condensers

    d. Control rods

16. Fission is a process in which atoms of uranium:

    a. Split

    b. Combine

    c. Fuse together

    d. Explode

17. The large dome-like structure that is often seen when approaching a nuclear power plant is the:

    a. Nuclear reactor

    b. Cooling tower

    c. Containment building

    d. Pressure building

18. In the event of a nuclear reactor accident, evacuation of offsite areas should:

    a. Always be performed regardless of radiation levels and other hazards

    b. Sometimes be performed depending on the proximity to the plant and the severity of the release

    c. Not be performed due to hazards involved with relocating people

    d. Be based on the projected time of the arrival of the plume and radiation levels

19. Radioactivity is the process where unstable atoms disintegrate or decay to stable atoms. The energy released in this process is called:

    a. The blast effect

    b. The shock wave

    c. A mushroom cloud

    d. Nuclear radiation

20. The type of radiation that is a major hazard due to its relatively high penetrating power is _____ radiation.

    a. Alpha

    b. Microwave

    c. Gamma

    d. Neutron

21. Dirt drawn up into the mushroom cloud of a nuclear detonation often returns to the earth as:

    a. Neutrons

    b. Acid rain

    c. Gamma rays

    d. Radioactive fallout

22. When radioactive particles from a nuclear detonation land on a surface, the original surface:

    a. Becomes permanently radioactive

    b. Becomes radioactive for a limited period of time

    c. Is considered contaminated, but does not become radioactive

    d. Is unaffected and is safe to walk about

23. Radiation levels naturally decrease due to radioactive:

    a. Decay

    b. Decontamination

    c. Equilibrium

    d. Absorption

24. The radiation exposure rate one week after a nuclear detonation should be approximately _____ the exposure rate in the same area one day after the blast.

    a. 10 times less than

    b. Equal to

    c. 10 times more than

    d. 100 times greater

25. Almost all of the world population's dose from radioactivity comes from _____ sources?

    a. Radon

    b. Natural

    c. Nuclear medicine

    d. Artificial

26. Taking a long distance trip in a _____ can result in a significant increase in someone's radiation dose:

    a. Passenger train

    b. Family van

    c. Airplane

    d. Sailboat

27. The source of most of the dose from natural sources of radiation is from what?

    a. Radon

    b. Lead

    c. The sun

    d. Consumer products

28. The most common medical procedure leading to an individual's collective dose of radiation is what?

    a. Radiotherapy

    b. Filling a cavity

    c. Blood pressure check

    d. X-ray

29. A person's exposure to cosmic radiation:

    a. Increases with altitude.

    b. Decreases with altitude.

    c. Is not possible.

    d. Can only be received in outer space.

30. The most likely consumer product that may be contributing to your dose of radiation (if you are wearing one) is what?

    a. A diamond bracelet

    b. A luminous dial wrist watch

    c. A diamond pendant

    d. A sterling silver belt buckle

PRETEST ANSWER KEY		
Test Item Number	**Correct Answer**	**If you answered the question incorrectly, study this unit:**
1.	b	Unit 1 Fundamental Concepts
2.	d	
3.	c	
4.	a	
5.	c	
6.	b	
7.	a	
8.	c	Unit 2 Radiological Transportation Accidents
9.	c	
10.	b	
11.	c	
12.	d	
13.	a	Unit 3 Nuclear Power Accidents
14.	c	
15.	c	
16.	a	
17.	c	
18.	b	
19.	d	Unit 4 Nuclear Threat
20.	c	
21.	d	
22.	c	
23.	a	
24.	a	
25.	b	Unit 5 Other Radiological Hazards
26.	c	
27.	a	
28.	d	
29.	a	
30.	b	